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VENTILATORS IN CEREMONIAL ROOMS OF PRE HISTORIC CLIFF-DWELLINGS

By J. WALTER FEWKES

The object of this article is to show that the inhabitants of the prehistoric cliff-dwellings of the Mesa Verde, in Colorado, invented and used ventilators to supply pure air at the floor level in certain of their subterranean rooms.

The special chamber set apart by Pueblo Indians for ceremonial purposes was called by the early Spanish discoverers an *estufa*, or stove, a name no doubt suggested by the great heat of the room when occupied. An estufa is commonly designated by the Hopi Indians a *kiva*,[1] which term is rapidly replacing the older name. It is found that prehistoric ruins as well as modern pueblos have kivas and that specialized rooms of this kind likewise exist in cliff-dwellings.

The kiva is the most important and generally the best constructed room in a pueblo, ancient or modern. In certain pueblos of the Southwest the kiva is the oldest room, and, from the very fact that it is devoted to religious practices, it preserves archaic features of construction, being less affected than secular dwellings by sociological changes. It is found in examining kivas of both modern and ancient pueblos that they differ in structure, form, size, and numerous minor peculiarities. It also appears that certain geographical areas have similar kivas and that other forms when found in these areas are intrusive. An examination of architectural variations and their distribution is important as bearing on the special subject of this paper.

Exceptional advantages were presented to the author to study the construction of kivas while in charge of excavation and repair work at "Spruce-tree House," one of the large cliff-dwellings of the Mesa Verde National Park.[1] This locality was particularly favorable for this study, as nowhere else in the Southwest are cliff-dwellers' kivas better preserved or more instructive in their teachings.

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[1] It is instructive to note that the Hopi word *kiva* has the same elements in composition as *va^{a}ki*, the Pima designation of a ceremonial building like Casa Grande. In both, *ki* means "house"; the significance of *va* is not apparent.

The type of kiva at Spruce-tree House is identical with that of other Mesa Verde ruins, and has a wide geographical distribution. It follows San Juan river and its tributaries as far west as the cliffs of the Cañon de Tseyi, or Chelly, and as far south as the great Chaco ruins in New Mexico. The kivas of the McElmo[2] and lesser cañons of the San Juan are morphologically the same as those of Spruce-tree House. Although aberrant examples of this type can be recognized a considerable distance from the Mesa Verde, the type reached its highest development on this tableland. Certain inhabited pueblos still retain the form of ceremonial rooms found in the Mesa Verde, but circular rooms of this kind do not occur in the western part of the Pueblo area or in the vast region extending from the Hopi villages to the northern boundary of Mexico.

There are two types of pueblo and cliff-house kivas: one circular, the other quadrilateral. The kivas of Spruce-tree House belong to the former group, and architecturally are among the highest in development of all these ceremonial rooms. In order to consider intelligently the kiva structure of which this article treats, the author has given below a brief sketch of the construction of the circular type.

The eight kivas of Spruce-tree House — except possibly Kiva A — are subterranean and constructed on the same general plan. In no instance are they built inside quadrilateral buildings, as is said to be the case with circular kivas elsewhere. The top of the roof is level, and continuous with the floor of the adjacent plaza; the main entrance being through a hatchway, descent into the room was by means of a ladder. Their walls are made of dressed stone, with plastered surfaces of mud and sand of different colors.

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[1] The excavation and repair work at Spruce-tree House was done under direction of the Secretary of the Interior.

[2] Mr S. G. Morley writes me that he has found similar kivas in the Cannonball ruin on the McElmo, not far from Holly's ranch. The recurrence of kivas of the same kind in rim-rock ruins and cliff-houses shows a homogeneity in the culture of the inhabitants.

We may describe the walls forming the enclosure as double, or as consisting of an outer wall (figs. 93, 94, B) and an inner wall (A), the latter ending a short distance from the floor. Between the top of the inner and the base of the outer wall there are six recesses separated by the same number of buttresses (C) which project from the outer wall into the kiva, so that the surface of the buttress facing the center of the kiva is flush with that of the inner wall. The horizontal portions of the recesses are banquettes that are generally paved with flat stones but are sometimes smoothly plastered.

The inner wall of each kiva has a rectangular opening (D), capped on the upper side by one or more flat stones forming part of the banquette. This opening is spacious enough to admit a man's body, the smoothly plastered inner surface showing no signs of smoke or fire. Its cavity narrows, as it recedes from the room, into a passage,[1] which, after extending horizontally a few feet, turns upward, opening externally at the level of the plaza. Here as a rule its walls are now broken, although in some instances evidences still remain that it did not formerly end at the level of the plaza. The ver-

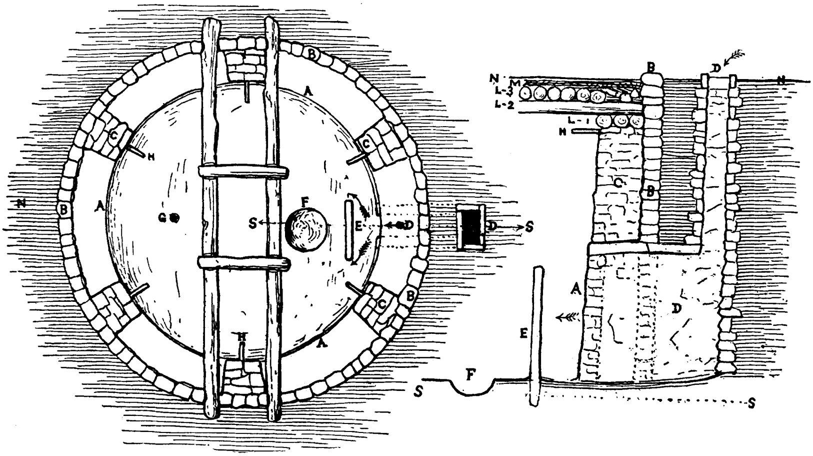

FIG. 93. — Plan of kiva in Spruce-tree House. A, inner wall; B, outer wall; C, pillar; D, air shaft; E, deflector; F, fireplace; G, sipapu; H, pegs; L1, first set of logs; L2, second set of logs; L3, logs covering top; L4, logs covering ends; M, bark and sticks; N, adobe.

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[1] Strangely enough, in each of three of the Spruce-tree House kivas a human skull and some other bones were found in the passage.

tical shaft probably turned again in a horizontal direction and opened externally through the wall which forms the front of the whole village, enclosing the plaza on the western side. This tunnel, which we may anticipate by calling a ventilator, is the subject of this paper and will be considered more at length later.

In addition to this opening in the side of the room, several kivas have also other lateral passageways situated between their floors and banquettes. These communicate with other rooms situated some distance away, or in some cases open exteriorly in the middle of the adjoining plaza. Through these subterranean tunnels one may with difficulty crawl from an outside room into a kiva, and at least one of these tunnels (Kiva G) is furnished with steps to facilitate the passage of one entering the room.[1] While a majority of the kivas are destitute of these tunnels, none lacks the vertical openings called ventilators.

The masonry buttresses (C) separating the recesses and the banquettes above mentioned, are square, or nearly so, in horizontal section, invariably provided with short pointed pegs (H) attached to their tops,[2] upon which the priests formerly hung the ceremonial paraphernalia. As in all sacred rooms, small niches, or cubby-holes, were constructed in the walls at convenient intervals. Meal or paint was formerly kept in these recesses, and in one kiva a small-necked bowl of coarse ware, set into the banquette, evidently served a similar purpose. As a rule, however, no niches of this kind exist in the upper walls or the sides of the buttresses.

The floor of a Spruce-tree House kiva is generally plastered, but in one instance is formed by the smooth surface of rock in place. When Kiva G was built, the rock surface projected unevenly, and, not being low enough for the kiva floor, was cut down six or eight inches on one side, presenting one of the most remarkable examples of rock cutting *en masse* the author has seen.

The circular fireplaces (F), situated a little to one side of the middle of the floor, were found to be packed solid with wood ashes. These fireplaces are merely deep cavities in the floor and apparently are lined with cement, not, as is usually the case, rimmed with slabs of stone set on edge, or with a raised border of adobe.

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[1] These passages were probably used by the chief priest, and not by others who entered the kiva. The regular entrance was through the roof.

[2] Ceremonial offerings, if any, are found on the top of these buttresses at the end of these pegs.

A flat upright stone (E), often replaced by a low wall about two feet high, projects from the floor between the fireplace and the kiva wall. This may be designated an "air deflector." The passageway to the ventilator (D), by which fresh air enters the kiva, is situated back of the deflector, in the lower or inner wall of the kiva.

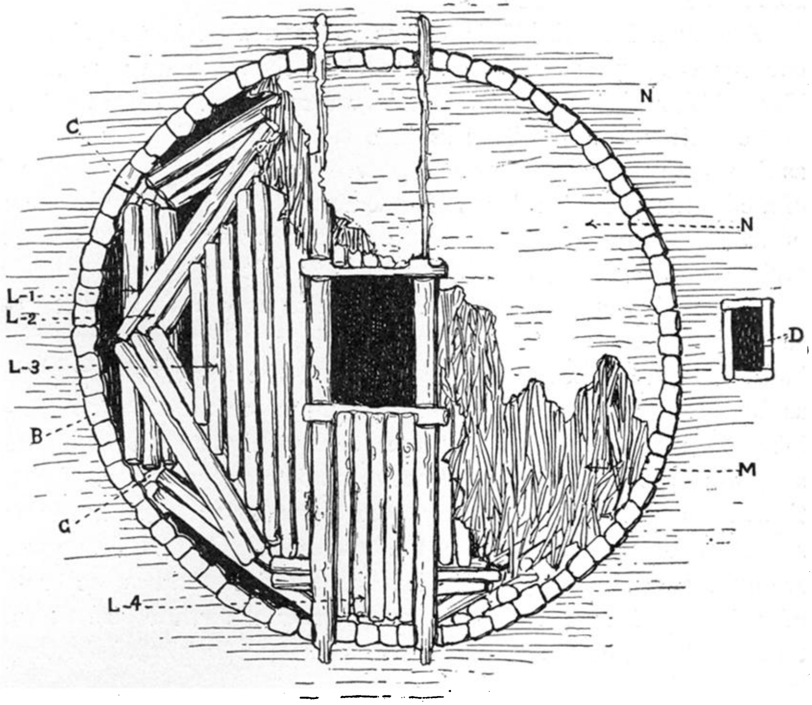

FIG. 94.— Plan of kiva roof at Spruce-tree House. (Compare fig. 93.)

There is a small circular opening (G) in the floor representing symbolically the entrance to the underworld, called by the Hopi the *sipapû*,[1] between the fireplace and the wall of the kiva directly opposite the deflector. This hole is only a few inches deep, and its sides are lined with the neck of a vase, the body of which is sometimes buried beneath the floor. The *sipapû* is the most revered place in the kiva, and about it are performed some of the most sacred rites.

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[1] This is the first recognition in print of a *sipapû* in a circular kiva.

The most complicated structure in a modern pueblo house is the roof, and the roof of a circular kiva was the most ambitious attempt at building undertaken by the prehistoric inhabitants of cliff-dwellings. All eight kivas of Spruce-tree House were roofed in the same way (fig. 94), but none of them had more than a few beams of the original roofing still in position. In clearing out the kivas, however, several well-preserved roof-beams of considerable size were brought to light.

Although Nordenskiöld[1] claims to have seen in the Navaho country a *hogan* with roof constructed in the same way as a Mesa Verde kiva roof, it is believed that he was mistaken. The coverings of these kivas have no likeness in construction to Navaho *hogans* as figured by Mindeleff[2] or as observed by the author. The roof of a cliff-dwelling kiva does not resemble that of any known form of habitation of non-agricultural people, and it was devised to meet architectural conditions foreign to nomadic culture.

The roof rests upon buttresses (C), which apparently were represented in some ancient kivas by upright logs. These supports, six in number, are placed equidistant[3] around the room. They serve as foundations for eighteen cedar logs (L^1) which are arranged peripherally and horizontally in threes, each triplet so placed on its supports as to span an interval between adjacent buttresses. Upon these rests another set (L^2) of eighteen logs, also arranged in threes spanning the sextants including the buttresses. On this second set are numerous other logs (L^3). It is to be noticed that, as each row of cedar logs is added crosswise on the row below, the size of the uncovered part of the kiva diminishes and the height of the roof is increased.

Two stout rafters extend diametrically across the kiva, with their ends resting on the outer wall. They are equidistant from and generally parallel with the last set (L^3) of peripheral logs, or those supported by the buttresses. These large logs serve as the main supports of the roof, especially its middle, where the strain is the greatest. Between them, midway in their length, lies the hatchway[1] through which one enters the kiva. The intervals between these logs and the last layer of crosswise peripheral logs arranged in threes are filled with sticks, the space between the two large beams being occupied by smaller poles resting on split beams. The last-mentioned beams form opposite sides of the kiva hatchway, and support the ladder.

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[1] *Cliff Dwellers of the Mesa Verde*, 1893.

[2] *Seventeenth Annual Report of the Bureau of American Ethnology*, pt. 2, 1897.

[3] The recess under which the ventilator passes is generally deeper and broader than the other.

Inserted in the crevices and openings between the logs above mentioned there are small sticks, split logs, and brush, and over the whole is spread a layer of shredded cedar bark (M). This covering supports a thick deposit of mud (N) filling all spaces above the supports and raising the roof level to that of the top of the outer wall of the kiva.[2] Nothing is visible on the roof of the kiva but a level floor broken by a hatchway in the center of a circle of stones marking the outer wall. This floor is continuous with that of the neighboring plaza when such exists.

The roofs of two of the kivas of Spruce-tree House were restored, following as a model those in the Square-tower House (Peabody House), where there is a considerable section of a kiva roof still fairly well preserved.[3] A kiva with covering constructed in the way described is somewhat more capacious than one with a flat roof resting on parallel rafters, although the height of the walls is the same. The inner surface of the roof is vaulted and its height considerably increased by the manner in which the logs are placed one above the other.

Kiva A[4] in Spruce-tree House presents the remarkable feature of a partially double-walled chamber, or of a circular room built inside an oval one. A section of the walls of the two is duplicated, the remainder being fused into a single wall. This kiva has an exceptional site, having been originally constructed close to the rear wall of the cave, while others are situated on top of the talus in front of the dwellings. Its floor is at a relatively higher level than the others, and rooms formerly stood in front of its outer walls.

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[1] No Mesa Verde kiva has yet been found with hatchway or ladder in place, but there is every probability that the entrance was in the roof. It is, however, extraordinary that no signs of the stumps of ladders or holes for the same were found in any of the eight kivas of Spruce-tree House.

[2] Nordenskiöld's schematic drawing of the roof of a kiva in Square-tower House does not tally with the author's observations. The roof logs in reality are arranged in threes, and not one above another as Nordenskiöld represents.

[3] In the restoration of the roof of one of the Spruce-tree House kivas the author was aided by Mr A. V. Kidder, who has given much attention to the structure of cliff-dwellings whose great help made this work possible.

[4] For convenience in reference the rooms of Spruce-tree House are numbered and the kivas lettered, the figures and letters being painted in black on the walls themselves.

It is probable that some time may have elapsed between the period of construction of the two parts of the double wall, and the larger is believed to be the older. The only explanation that has suggested itself to the author to account for the double wall of Kiva A is the following: It may have been that after the larger kiva was finished and roofed the ventilation was found to be insufficient or such that the smoke and vitiated air were not properly carried off. The smaller kiva was built within the other and nearer the ventilator, to obviate this defect.[1]

The construction of the different parts of the kiva and their significance have been considered by several investigators, among whom may be mentioned Mindeleff and Nordenskiöld, the latter the most prominent student of the Mesa Verde ruins. It should be pointed out that Mindeleff's studies of circular kivas were made in Cañon de Chelly, while those of Nordenskiöld were conducted at the Mesa Verde. It is possible that there is some difference in the construction of ceremonial rooms in these two areas, notwithstanding the kivas in them belong to the same general type.

The plan of the principal kiva in Mummy-cave ruin, in the Cañon de Chelly region, as given by Mindeleff,[2] shows a style of architecture morphologically identical with that of the kivas of Spruce-tree House. A ventilator and a deflector are present, but the fireplace and *sipapû* are absent.[3] These kivas appear to have had only a few buttresses, and not many banquettes and lateral recesses. Their present form would indicate that Cañon de Chelly lies on the outskirts or periphery of that cultural area in which the circular type of kiva reached its maximum development.[4]

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[1] The shaft partially excavated several years ago by Mr W. K. Moorehead at Aztec, New Mexico, may later be found to be the ventilator of some adjacent room. See *American Anthropologist*, N. S., X, April–June, 1908.

[2] Op. cit., p. 186, fig. 82.

[3] These will probably be found through excavation by experienced archeologists in this interesting locality.

[4] Kiva B of Spruce-tree House is the closest approximation of all to the Cañon de Chelly kivas.

Nordenskiöld has given a fairly good general sketch of a typical kiva of the Mesa Verde ruins, from which the following quotation is made:

> "Between the fireplace and the outer wall stands a narrow curved wall eight-tenths of a meter high. Between this wall in the same plane as the floor a rectangular opening one meter high and six-tenths of a meter broad has been constructed in the outer wall. This opening forms the mouth of a narrow passage or tunnel of rectangular shape which runs 1.8 meters in a horizontal direction and then goes straight upward on into the open air. The tunnel lies under one of the six niches which is somewhat deeper than the others. The walls are built of carefully hewn blocks of sandstone, the inner surface being perfectly smooth and lined with a thin yellowish plaster. On closer examination of this plaster it is found to consist of several thin layers each of which was black with soot. It is difficult to say for what purpose this tunnel has been constructed and the slab of stone or the wall erected in front of it. As I have mentioned above this arrangement is found in all the estufas."[1]

Each kiva of the cliff-dwellings of Cañon de Chelly, according to Mindeleff, was erected inside a rectangular room, and in a "few instances the space between the outer rectangular wall and the inner circular wall was filled solid and perhaps was so constructed, but usually the walls are separated and distinct." Although an outer quadrilateral wall enclosing the circular kiva does not exist in Spruce-tree House, it is not unknown in Mesa Verde ruins. This feature was probably a necessity in Cañon de Chelly, where the rooms were built above ground on account of the exigencies of the rocky site. In no better way could the ancient inhabitants fit buildings of circular form into angular spaces than by enclosing them in quadrilateral rooms.

No structural difference between circular and quadrilateral kivas is more radical than in the mode of building the roofs. According to Mindeleff, in the Cañon de Chelly "the roof of the kiva was the roof of the chamber that inclosed it." However this may be in the roofing of the circular kivas referred to, it does not apply to those of the Mesa Verde. The author predicts that when the method of roofing circular kivas in Cañon de Chelly is determined by scientific excavation, it will be found to be the same as in the Mesa Verde.[1] According to Nordenskiöld: "The simplest way of roofing an estufa, an example of which was observed in another estufa at Square-tower House [Peabody House], is to lay poles horizontally across the room — poles of sufficient length may easily be procured of piñon or cedar. This form of roof is also the general one in all quadrilateral rooms." The author believes that the roofs of both the Peabody House kivas were constructed in a style not unlike that which has been restored in Kiva C of Spruce-tree House, the details of which are shown in the accompanying illustration (fig. 94). In studying roof construction Nordenskiöld overlooked the two main rafters of one kiva of Peabody House, and supposed that the beams spanning the opening of another indicated a difference in the manner of building the roofs. It is believed that there was no radical difference in the construction of these two roofs, but that both were built in the same general way.

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[1] Although, as Mindeleff points out, an inspection of Nordenskiöld's ground-plan shows more kivas without this feature than with it, the statement in the text of the above quotation is correct, the ground-plans being faulty in this particular.

Four theories have been presented to account for certain lateral openings, or "chimney-like structures," in the circular kivas: (1) that they are chimneys; (2) that they are passageways or entrances; (3) that they served some ceremonial purpose; (4) that they are ventilators. The theory that they were chimneys seems to have been dismissed by all authors, for they exhibit no sign of smoke. The expression "chimney-like" structure may however persist as a good, although misleading, term by which to designate them. The third theory is too vaguely stated to be discussed.

In considering the second theory, or that these lateral passageways are entrances to the rooms, it must be borne in mind that in some of the kivas of Spruce-tree House, and probably in others of the same culture area, the kivas sometimes have underground lateral openings of two kinds, some of which are entrances. The size and structure of the former, or that by which one enters a kiva from a neighboring room or plaza, and that of the latter — the problematical structures — are quite different, although their openings into the kivas closely resemble each other. When seen from a subterranean chamber they might readily be mistaken one for the other, and without excavation the observer would be at loss to know how to distinguish them. One of these doubtful passageways was described by Professor Holmes[1] many years ago, in a ruin not far from those under discussion. Mindeleff, in considering his description, refers the structure designated as a "covered passageway" to the same category as the "chimney-like" structures of the Cañon de Chelly, but points out that "the tunnel is much larger than usual and the vertical shaft, if there were one, has been so much broken down that it is no longer distinguishable." The tunnel in the ruin described by Holmes might be either an entrance to the kiva or a ventilator, but as no sign of the more constant structure called a ventilator is seen in his ground-plan, it is possibly the latter.

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[1] As is known to students of the Mesa Verde ruins, there are several circular rooms that are not kivas.

The strongest and probably a fatal objection to the second theory of vertical passageways in the Spruce-tree House kivas is that they are too small to allow the passage of even a child, much less an adult. The fourth theory is supported by all the known facts, and the objection to it turns out to be of a most specious nature when analyzed.

Nordenskiöld finds the entrance and chimney hypotheses unsatisfactory. He is not satisfied with the ventilator theory, but does not state his objections. Mindeleff regards all three theories untenable, and thus writes regarding the ventilator: "Ventilators according to this method [the introduction of fresh air on a floor level, striking on a deflector and being thus distributed in the room[2]] is a development in house architecture reached by our own civilization within the last few decades." He adds, however, the following paragraph which shows that he is not wholly opposed to the third theory: "There can be little doubt that the chimney-like structures were not chimneys and no doubt at all that they did provide an efficient means of ventilation no matter what the intention of the builders may have been."

In quadrilateral kivas thus far described, except possibly the kiva of Wukoki, a ruin at Black Falls on the Little Colorado, mentioned by the author,[1] no air flues have yet been found. Modern Hopi kivas, which like those of Spruce-tree House are subterranean, but unlike them in being quadrilateral, have no air vent except the kiva hatchway. As a rule quadrilateral kivas are much larger and their roofs higher than those of circular kivas, so that the ventilation, which is also facilitated by a more capacious hatchway, is not a matter of great concern. The suggestion — it could hardly be regarded as more — that the discovery of the principle of supplying fresh air to a room at the level of the floor was too advanced for a people whose knowledge of architectural principles is said to have been so limited as that of the ancient cliff-dwellers, is contrary to observation, which shows that the cliff-dwellers had discovered this principle and applied it in their kivas. They were compelled to discover it, for otherwise it would have been impossible for one person, much less for several, to remain in a subterranean chamber so small as these, even with a moderate fire burning. Without adequate ventilation, smoke would have driven them out.

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[1] *Tenth Ann. Rep. U. S. Geol. and Geog. Survey*, Washington, 1878, p. 395.

[2] The Tobin system introduces fresh air above the level of entrance.

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[1] *Twenty-second Annual Report of the Bureau of American Ethnology*, p. 49.